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Praziquantel preventive chemotherapy for young children, Madagascar

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Feasibility of paediatric schistosomiasis prevention with praziquantel, Madagascar

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Abstract

Objective To assess the feasibility of fixed-dose, praziquantel preventive chemotherapy against schistosomiasis in young children in rural Madagascar, focusing on treatment uptake and sustainability.

Methods We used the Consolidated Framework for Implementation Research to guide the study. Between November 2022 and December 2023, children aged 9 to 24 months at various venues were offered 300 mg of praziquantel as a crushed half tablet mixed with water and sugar. We conducted a cross-sectional survey among caregivers to assess treatment uptake and acceptability, children's compliance with drug administration, anxiety about adverse events, and praziquantel's tolerability and safety. Factors associated with uptake and acceptability were identified using Poisson regression.

Findings The study analysis included 5142 child–caregiver pairs. The praziquantel uptake rate was 86.2% (95% confidence interval, CI: 85.3–87.1) and 80.2% (95% CI: 79.1–81.3) of caregivers regarded repeated preventive chemotherapy acceptable. Clear anxiety,

and uncertainty, about adverse events were the most significant factors associated with refusal of both initial and repeated treatment. No children experience serious adverse events or choking. Of the 4434 children who received praziquantel, only 152 (3.4%) were inadequately treated due to spitting, whereas 2467 (55.6%) cried and 1833 (41.3%) initially resisted treatment but ultimately received it.

Conclusion Fixed-dose praziquantel preventive chemotherapy using a crushed half tablet with water and sugar was feasible in preschool-aged children and was potentially sustainable. This approach has a strong potential for scaling up in areas where schistosomiasis is highly endemic.

Introduction

Mass drug administration with praziquantel has long been the main public health strategy for combating schistosomiasis.¹ Over time, the global approach has shifted from disease control to elimination,² which has resulted in stronger recommendations on snail control, environmental management and access to safe water, and an expansion in the target group for mass drug administration from school-aged children to include adults and preschool-aged children, as outlined in the 2022 World Health Organization (WHO) guidelines.³ This shift was driven by growing evidence of schistosome infection and morbidity in preschool-aged children, the impact of community-wide treatment on transmission,⁴ and the increased availability of praziquantel.⁵ Nevertheless, operational challenges remain, particularly when including young children in praziquantel mass drug administration campaigns.⁵

Praziquantel is produced in 600-mg tablets, which can be halved for intake by adults and school-aged children, but only some brands allow accurate quartering for weight-based or height-based dosing for preschool-aged children.⁶ The drug's bitter taste, even when crushed and mixed with sugar for young children, further reduces compliance.^{5,7} A paediatric formulation, orodispersible arpraziquantel, has been approved by the European Medicines Agency and partially addresses these issues.⁸ The initial roll-out of arpraziquantel started in some countries in 2025. However, supply was limited, only about 10 million tablets were available annually versus an estimated need for 50 million.^{5,9} Crushed praziquantel could provide an important complement to the paediatric formulation and increase coverage.

Another challenge is identifying effective delivery platforms. Experience with mass drug administration strategies for school-aged children and adults shows that coverage depends on the delivery method as well as on individual factors and that sustaining high coverage is difficult, especially for preschool-aged children.¹⁰⁻¹² The integration of mass drug administration with existing child health programmes or community campaigns would be ideal but may face financial, logistic and sustainability constraints.¹³ The WHO recommends three routine health visits for children aged 9 to 24 months.¹⁴ These visits provide opportunities for integrating schistosomiasis

treatment into services at primary health-care centres and for ensuring that children receive at least one treatment before reaching school age.

In Madagascar, where schistosomiasis is prevalent and access to health care is limited, particularly in rural areas, school-based mass drug administration is the main treatment strategy.¹⁵ The aim of our study was to assess the feasibility of delivering fixed-dose praziquantel preventive chemotherapy to children aged 9 to 24 months in Madagascar through existing health systems and programmes.

Methods

We adapted the Consolidated Framework for Implementation Research to our study's context by identifying specific framework subdomains and process steps that could influence both the implementation and outcomes of praziquantel preventive chemotherapy for young children (Fig. 1).¹⁶ Our intervention was designed in collaboration with Madagascar's National Schistosomiasis Control Programme, local academic stakeholders and the national reference centre for infectious disease surveillance, the *Centre d'Infectiologie Charles Mérieux*. We identified critical elements to be added to the Framework (Table 1) through a collaborative rapid assessment approach that involved meetings with our partners and interviews with key informants, such as community leaders, facility managers and national stakeholders.¹⁷ Ethical approval was obtained from the National Ethics Committee of Madagascar (N°019MSANP/SG/AMM/CERBM) and the Hamburg State Medical Chamber's Ethics Committee in Germany (2022–100935-BO-ff).

Planning and implementation

All partners met weekly during the 12 weeks before study initiation (i.e. from November 2022 to January 2023) and throughout the intervention. We collected qualitative data through semistructured interviews with community health workers, community members and national stakeholders using open-ended questions on the principal topics of interest, such as drug availability, site accessibility and perceived environmental safety. Study sites were specially selected to assess the feasibility of the intervention, the integration of the intervention at different health-care levels, and variations in caregiver behaviour outside of health-care settings. Before implementation, the primary health-care centre infrastructure and drug availability at each site were assessed and supplies for the management of adverse events and praziquantel supplies were secured. Two medical coordinators managed the supply chain, supervised study implementation, data collection and adverse event management, and reported to the national surveillance system for adverse events. In addition, 22 health workers underwent one day's training in basic adverse event management, which was further addressed in three meetings with the head doctors at primary

health-care centres. A patient transfer protocol using private transport was established for cases requiring inpatient care and standard operating procedures were developed to support the intervention. Weekly reports on study enrolment, praziquantel administration, adverse events and consumable use were produced, which enabled local stakeholders to make responsive adjustments.

The intervention lasted 14 months and took place in the Boeny region of north-western Madagascar, where *Schistosoma haematobium* is highly endemic (i.e. endemicity greater than 50%) and where there are health system and sociodemographic fragilities:¹⁵ most residents live in rural areas, 6.5% of the population is younger than 5 years, and access to schools, health care, clean water and sanitation remains limited.¹⁸ The intervention involved 13 primary health-care centres, one district hospital and two community sites, which were selected on the recommendations of key informants and on the basis of local epidemiological and demographic data. Caregiver–child pairs were recruited in four contexts: (i) at primary health-care centres during unplanned consultations; (ii) at primary health-care centres during routine paediatric or immunization visits; (iii) at the district hospital during unplanned consultations; and (iv) in places where the community gathered.

For inclusion in the study, caregivers had to give written informed consent in Malagasy and children had to be aged between 9 and 24 months. Exclusion criteria included ongoing pathological conditions, epilepsy, antiepileptic or antitubercular treatment with rifampicin or rifapentine, and a known allergy to praziquantel.

Children received a fixed 300-mg dose of praziquantel after a snack (i.e. a biscuit and fruit juice) in the form of a crushed half 600-mg tablet mixed with water and sugar. This dose was based on WHO's recommended dose range of 30 to 60 mg/kg adapted to Malagasy weight-for-age and height-for-age estimates.^{19,20} Mean weight-for-age and height-for-age values for Malagasy children aged 9 to 24 months were reported to fall between the -1 and -2 z -scores for WHO child growth standards,²¹ which meant the dose administered was consistent with praziquantel dosage recommendations given by the height-based extended dose pole.^{22,23} Praziquantel administration was observed by health workers, who used comforting strategies such as encouraging small sips and pauses to ease ingestion. If the child spat out a substantial amount, no additional dose was given for safety reasons and treatment was considered inadequate.

Intervention assessment

We assessed two main outcomes of the intervention: (i) treatment uptake by children; and (ii) the sustainability of the intervention among caregivers, where we defined sustainability as the proportion of caregivers who regarded repeated preventive chemotherapy for children as acceptable. In addition, the safety and tolerability of treatment, treatment compliance and satisfaction with

treatment and health workers were also evaluated (Table 2).^{24–26} Outcomes were measured using a cross-sectional study design with data collected between February and December 2023.

Data management

Trained health workers conducted face-to-face interviews with caregivers in French or Malagasy using a structured, paper-based questionnaire. The questionnaire had five sections: (i) the sociodemographic characteristics of the child and caregiver; (ii) the caregiver's awareness and knowledge of schistosomiasis and praziquantel; (iii) the caregiver's willingness to accept, and perception of, praziquantel treatment; (iv) the caregiver's satisfaction with treatment and health workers; and (v) the child's compliance with treatment, and adverse events.

Data were checked manually for missing entries by health workers involved in the study and medical coordinators, and data were entered into a REDCap database (Vanderbilt University, Nashville, United States of America) using double data entry.²⁷ Quality control of data processing and validation was undertaken at regular intervals during and at the end of data entry. An external data manager monitored the data entered and requested and recorded checks and amendments.

Sample size

Based on operational considerations, such as the availability of resources and an expected treatment capacity of a maximum of 10 individuals per day, the total number of caregiver–child pairs to be recruited was set at 5200. This sample size was sufficient to detect a 2-percentage point difference in praziquantel uptake from the WHO threshold for successful mass drug administration of 75%, in either direction, at a 5% significance level and with a power of 90%. The sample size also enabled meaningful evaluation of the sustainability of the intervention, the tolerability of praziquantel, and adverse events. A convenience, non-probability sampling strategy was employed to select caregiver–child pairs.

Statistical analysis

The characteristics of the children and caregivers are reported using descriptive statistics and include both absolute and relative frequencies. The proportions of caregivers who agreed to praziquantel treatment, who refused praziquantel and who regarded repeated preventive chemotherapy as acceptable were estimated with 95% confidence intervals (CIs). To identify factors associated with treatment refusal and the acceptance of repeated preventive chemotherapy, we estimated crude and adjusted prevalence ratios (PRs) using Poisson regression models with robust standard errors. Separate models were fitted for each outcome. Median satisfaction scores were estimated for caregivers' satisfaction with the treatment offered and with health workers and

the significance of the difference between caregivers who accepted praziquantel treatment and those who refused it was estimated using the Mann–Whitney *U* test. Adverse events among praziquantel-treated children are reported using absolute and relative frequencies. Observations that included missing data on outcomes or independent variables were excluded from the analysis. A two-sided *P*-value of less than 0.05 was considered significant.

Results

Conceptualization of the intervention

Elements in the outer setting (Fig. 1) that emerged as barriers to the treatment of young children included: (i) local availability of praziquantel and drugs for the management of adverse events; (ii) stakeholder engagement; (iii) external policies and incentives; and (iv) the need for adapted guidelines. In the inner setting, we identified the following factors as critical for effective implementation of the treatment strategy: (i) the resources available; (ii) the physical and work infrastructure available for treatment; and (iii) culture (e.g. caregivers' recipient-centredness and knowledge). Finally, both the users (i.e. children and caregivers) and providers of the health service were identified as critical to the success of the intervention (Fig. 1). Following consolidation meetings with stakeholders, the intervention was conceptualized and approved by all involved.

Treatment uptake

In total, 5163 caregiver–child pairs were recruited. Following data quality checks, 5142 pairs were included in the analysis (details are available in the online repository).²⁸ Most participants (77.2%; 3971/5142) were recruited at primary health-care centres during unplanned consultations, followed by 16.9% (868/5142) recruited at primary health-care centres during routine paediatric or immunization visits (Table 3). In addition, 4.0% (207/5142) and 1.9% (96/5142) were recruited at the district hospital and at community gathering places, respectively. The sociodemographic characteristics of caregivers and children are also reported in Table 3. Praziquantel uptake was accepted by 86.2% (4434/5142; 95% CI: 85.3–87.1) of caregivers, whereas 13.8% (708/5142; 95% CI: 12.9–14.7) refused treatment.

Of the 5142 caregivers, 4202 (81.7%) considered children to be at risk of schistosome infection and 2653 (51.6%) believed the infection could present asymptotically (Table 4). Moreover, 2011 (39.1%) reported prior family experience with praziquantel preventive chemotherapy, whereas 2123 (41.3%) reported no experience. Praziquantel was generally perceived positively: 65.8% (3385/5142) of respondents expressed favourable views regarding its perceived efficacy against schistosomiasis and only 15.2% (784/5142) reported anxiety about adverse events.

Factors influencing uptake

Overall, 708 caregivers refused praziquantel treatment for their child. Refusal was significantly associated with; (i) secondary (adjusted PR, aPR: 1.41; 95% CI: 1.07–1.87) and tertiary (aPR: 2.25; 95% CI: 1.60–3.16) education, relative to no education; (ii) not being the child's parent, relative to being the child's mother (aPR: 1.72; 95% CI: 1.30–2.27); and (iii) being unmarried, relative to being married (aPR: 1.22; 95% CI: 1.04–1.43). Crude PRs are reported in the online repository.²⁸ In contrast, being a farmer was inversely associated with the refusal of praziquantel (aPR: 0.68; 95% CI: 0.57–0.81). No significant association was observed with the child's sex. However, refusal was inversely associated with the child's age: relative to the caregivers of children aged 18 to 24 months, the aPR for refusal was 1.49 (95% CI: 1.27–1.75) for the caregivers of children aged 9 to 12 months and 1.26 (95% CI: 1.06–1.49) for the caregivers of children aged 13 to 17 months. A lack of awareness of children's risk of schistosomiasis was also associated with refusal (aPR: 1.51; 95% CI: 1.14–2.01), as was no, or uncertainty about, previous family experience with praziquantel preventive chemotherapy versus previous experience: the aPR was 1.78 (95% CI: 1.47–2.16) and 1.84 (95% CI: 1.47–2.30), respectively. Anxiety about adverse events showed the strongest association with refusal: the aPR was 3.60 (95% CI: 2.93–4.44) relative to caregivers with no anxiety and that association remained significant even among caregivers who were uncertain about adverse events (aPR: 2.95; 95% CI: 2.41–3.61; Fig. 2).

Sustainability of praziquantel treatment

The praziquantel intervention continued consistently for 44 weeks, with an average of 117 caregiver–child pairs included per week. Regular feedback on implementation challenges was collected by the study team. The sustainability assessment found that 80.2% (95% CI: 79.1–81.3) of caregivers (4124/5142) regarded repeated preventive chemotherapy as acceptable (Table 4).

There was a significant positive association between acceptance of repeated treatment and the caregiver's age (Fig. 3): relative to those younger than 25 years, the aPR for acceptance was 1.04 (95% CI: 1.01–1.07) for those aged 25 to 34 years and 1.07 (95% CI: 1.03–1.11) for those aged over 34 years. However, relative to being a mother, there were inverse associations with being a father (aPR: 0.87; 95% CI: 0.82–0.93) and being a caregiver who was not the biological mother (aPR: 0.94; 95% CI: 0.88–1.00). Compared with not being a farmer, being one was also inversely associated with acceptance of repeated treatment (aPR: 0.90; 95% CI: 0.87–0.92). In addition, relative to caregivers recruited during routine paediatric or immunization visits, those recruited at the district hospital were less likely to favour repeated treatment (aPR: 0.76; 95% CI: 0.68–0.85), whereas there was no significant association with recruitment in any other context. Uncertainty about, or a lack of awareness of, the risk of schistosome infection, the risk of reinfection after

praziquantel treatment or the possibility of asymptomatic infection among children and no, or uncertainty about, previous family experience with praziquantel preventive chemotherapy were all associated with a reluctance to accept repeated treatment. However, the strongest negative association with acceptance was anxiety about adverse events: relative to those who were not anxious, the aPR for acceptance was 0.84 (95% CI: 0.81–0.87) for caregivers who were clearly anxious and 0.66 (95% CI: 0.63–0.70) for those who reported being unsure whether they were anxious. Crude PRs are reported in the online repository.²⁸

Treatment compliance, adverse events and service satisfaction

Among the 4434 children treated with praziquantel, 2467 (55.6%; 95% CI: 54.2–57.1) cried and 1833 (41.3%; 95% CI: 39.9–42.8) initially resisted but ultimately received treatment. Only 152 (3.4%; 95% CI: 2.9–4.1) spat during praziquantel administration. There were no episodes of choking. Fifty-two children experienced adverse events within 30 minutes after treatment (1.2%; 95% CI: 0.9–1.5): the most common were vomiting, in 29 (0.7%; 95% CI: 0.5–0.9), and drowsiness, in 22 (0.5%; 95% CI: 0.3–0.8). Details are available in the online repository.²⁸ No deaths or serious adverse events were reported within 30 days of treatment.

Caregivers who accepted praziquantel treatment reported significantly higher satisfaction with study health workers than those who refused: the median satisfaction score was 9 (interquartile range, IQR: 8–10) and 8 (IQR: 7–9) in the two groups, respectively (P -value: <0.001); corresponding median satisfaction scores in the two groups for the treatment offered were 9 (IQR: 8–10) and 8 (IQR: 7–9), respectively (P -value: <0.001). Details are available in the online repository.²⁸

Discussion

Our study demonstrated that preventive chemotherapy for schistosomiasis using crushed, fixed-dose praziquantel tablets in children aged 9 to 24 months was feasible in rural Madagascar. Most children received praziquantel, and treatment was highly tolerable and compliance was good. In addition, most caregivers regarded repeated praziquantel treatment for their child as acceptable. Moreover, our approach proved child-friendly; fewer than 5% of children were inadequately treated. The main factor associated with praziquantel refusal was caregiver anxiety about adverse events.

Use of 300-mg half tablets simplified treatment delivery while meeting WHO's recommended dose range for Malagasy children, based on weight-for-age and height-for-age estimates.¹⁸ Although there are concerns about undertreatment and resistance, the low adverse event

rate of 1.2% we observed and evidence from higher-dose studies suggest that the use of entire 600-mg tablets could further simplify administration.²⁹

This approach is probably applicable to similar settings. However, factors influencing praziquantel uptake vary by country, target population and distribution strategy.¹¹ The studies available indicate that anxiety about adverse events and the caregiver's educational level are the greatest emerging barriers to mass drug administration, especially for diseases involving preschool-aged children,^{30,31} as we found. Consequently, building trust in individuals and the general public plays a critical role in balancing the emotional factors that drive decisions about treatment,³² particularly for preventive measures, such as childhood vaccination.³³ The introduction of targeted awareness initiatives for participants, combined with a strong adverse event management system, could help increase trust and decrease anxiety, thereby boosting the success of mass drug administration programmes. Interestingly, farmers in our study were less willing than non-farmers to participate in repeated preventive chemotherapy, probably because of work constraints, which suggests that the use of integrated health services, for example, rather than short vertical campaigns may increase coverage, as also indicated by studies in Uganda.^{34,35}

Despite structural challenges, collaboration with local health workers, stakeholder partnerships and the efficient use of existing health-care systems enabled us to implement praziquantel preventive chemotherapy in young children with few additional resources.

Scaling up will require a shift in the concept of mass drug administration involving funding and the mutualization of resources and activities across health-care sectors because highly vertical public health strategies remain in place in many low- and middle-income countries.³⁶ Currently, the praziquantel that reaches countries where schistosomiasis is endemic is funded by donations and campaigns target mostly school-aged children.³⁷ A successful integrated strategy would involve additional costs for investments in optimizing training and monitoring. Our study shows that integrating schistosomiasis activities into existing health structures is feasible. However, cost-effectiveness analyses should be conducted to verify the financial advantages of preventive chemotherapy for national health programmes. Context-specific factors, including cultural and anthropometric differences, must also be considered in generalizing our findings. We found that the venue for praziquantel administration did not seem to play a critical role in the caregiver's decision to accept treatment, though uptake tended to be lower in non-hospital settings. This finding should be further investigated to provide guidance on integrating services at the primary care level, especially for vulnerable groups, such as pregnant women.³⁸

Our study has several limitations. First, the praziquantel uptake rate was calculated using the number of study participants as the denominator rather than an estimate of the number of children in the same age group in the general population, as suggested by WHO. Consequently, caution is warranted in comparing our findings with programmatic indicators defined by WHO. Second, our use of a convenience, non-probability, sampling strategy could have led to selection bias, which may have affected the external validity and generalizability of our findings. As with any survey, self-reporting is associated with certain biases, such as the influence of the social desirability of the intervention. In addition, recall bias cannot be completely ruled out. Nevertheless, we are confident that the risk was mitigated by the deployment of experienced health workers, training for health workers and continuous supervision. The passive approach adopted for reporting late-onset adverse events may have made monitoring difficult. However, as this was an implementation study, we prioritized integration into the existing national surveillance system for adverse events in an attempt to mimic the real-life scenario of mass drug administration.

To conclude, our study presents a feasible and potentially sustainable model for treating young children with crushed praziquantel tablets. Given that the availability of paediatric praziquantel formulations is often limited, our approach offers a practical alternative for boosting treatment for preschool-aged children. The integration of praziquantel administration into routine paediatric health visits would require few additional resources and would be highly acceptable and tolerable. By helping ensure that every child receives at least one treatment before school age, our strategy would contribute to overall improvements in the health and development of children in settings where schistosomiasis is endemic.

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Competing interests:

None declared.

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Table 1. Critical subdomains of the Consolidated Framework for Implementation Research,¹⁶ implementation of praziquantel preventive chemotherapy for young children in rural Madagascar, 2023

Framework domain, critical subdomain	Action
Outer setting	
Drug availability	Establish a supply chain for praziquantel procurement and identify medical coordinators
Stakeholder engagement	Engage health workers in the local health-system
External policies and incentives	None proposed
Adapted guidelines	(i) Develop standard operating procedures that cover training for drug administration and the management of adverse events; (ii) reinforce adverse event surveillance through linkage to Madagascar's national surveillance system for adverse events; and (iii) strengthen capacity for adverse event management
Inner setting	
Resources available	Identify local resources, including equipment at primary health-care centres, supplies of consumables (e.g. drugs to treat adverse events, such as corticosteroids, paracetamol, antihistamines and antidiarrheals) and medical supplies
Caregivers' access to knowledge and information	Integrate items on knowledge and information into the survey questionnaire to inform awareness campaigns tailored to the local context
Physical and work infrastructure	Coordinate with local authorities to secure suitable spaces in health-care facilities for the intervention
Gender-neutral recipient-centredness	Integrate items on the importance of gender into the survey questionnaire to inform awareness campaigns tailored to the local context
Individual setting	
Recipient's compliance with praziquantel administration	Include dedicated items on choking-related adverse events and children's compliance with treatment in the survey questionnaire
Caregivers (i.e. key decision-makers)	Identify factors associated with praziquantel uptake and the acceptability of repeated preventive chemotherapy (i.e. individual routinization)
Health workers (i.e. key influencers)	Arrange training and information sessions for local health workers

CFIR: Consolidated Framework for Implementation Research.

Table 2. **Study outcomes, implementation of praziquantel preventive chemotherapy for young children in rural Madagascar, 2023**

Outcome	Definition	Data source	Data analysis
Primary outcome			
Treatment uptake	Ratio of the number of children treated with praziquantel (with their caregivers' consent) to the number of children enrolled in the study	Answer to the survey questionnaire item: "If we offer free schistosomiasis treatment to children aged 9 to 24 months, would you now agree to your child being treated?" (Response options: yes; no; and maybe but not today)	(i) Responses were combined into two dichotomous outcomes: no and maybe but not today versus yes; and (ii) Poisson regression was used to identify factors associated with treatment uptake
Sustainability of the intervention	Percentage of caregivers who regarded repeated preventive chemotherapy for children as acceptable	Answer to the survey questionnaire item: "Do you think it would be a good idea to offer praziquantel for the treatment of schistosomiasis as a regular treatment for children?" (Response options: yes; no; and I do not know)	(i) Responses were combined into two dichotomous outcomes: yes versus no and I do not know; and (ii) Poisson regression was used to identify factors associated with acceptance of repeated preventive chemotherapy
Secondary outcome			
Treatment compliance	Health workers' observation of a child resisting treatment, crying or having an adverse swallowing event (e.g. choking, splitting or vomiting) during drug administration ²⁴	Treatment compliance events were reported systematically by health workers and through the survey questionnaire	Descriptive analysis
Treatment tolerability	The appearance of adverse events in the 30 minutes after praziquantel administration	(i) Health workers systematically reported vomiting, rashes, oedema, fever and inconsolable crying; (ii) any additional sign or symptom was reported in response to open-ended questions on the survey questionnaire; and (iii) side-effects were graded for severity	Descriptive analysis
Treatment safety	The occurrence within 30 days of receiving praziquantel of death, hospitalization or any unusual or rare adverse event classified by health workers as grade-3 to 5 in severity ^a	(i) Active surveillance by health workers in the 30 minutes after praziquantel administration; and (ii) passive surveillance by caregivers who reported to study health workers until 30 days after administration	Descriptive analysis
Sustainability (i.e. continued delivery of the intervention)	(i) Number of trained personnel available; (ii) adequate provision of drugs to primary health-care centres; (iii) development of standard operating procedures; and (iv) integration of praziquantel preventive chemotherapy into the health-care system	(i) Weekly meetings with study partners; (ii) interviews with key informants, such as community leaders, facility managers and national stakeholders; and (iii) weekly study reports	(i) Collaborative, rapid assessments; and (ii) reviews of project reports

^a Any grade-3 to 5 adverse event has to be reported to Madagascar's Ministry of Health in accordance with national pharmacovigilance procedures.

Table 3. Characteristics of caregivers and children, study of praziquantel preventive chemotherapy for young children in rural Madagascar, 2023

Characteristic	No. (%) (n = 5 142)
Recruitment context	
Primary health-care centre during an unplanned consultation	3971 (77.2)
Primary health-care centre during a routine paediatric or immunization visit	868 (16.9)
District hospital during an unplanned consultation	207 (4.0)
Community gatherings	96 (1.9)
Child's sex^b	
Female	2579 (50.2)
Male	2563 (49.8)
Child's age, in months	
9–12	1699 (33.0)
13–17	1590 (30.9)
18–24	1853 (36.0)
Caregiver had health insurance	
No	4141 (80.5)
Yes	1001 (19.5)
Caregiver's type	
Mother	4662 (90.7)
Father	254 (4.9)
Other ^a	226 (4.4)
Caregiver's sex^b	
Female	4864 (94.6)
Male	278 (5.4)
Caregiver's age, in years	
< 25	1999 (38.9)
≥ 25 to 34	2375 (46.2)
≥ 35	768 (14.9)
Caregiver's educational level	
No education	410 (8.0)
Primary	1979 (38.5)
Secondary	2361 (45.9)
Tertiary	392 (7.6)
Caregiver's marital status	
Married	4376 (85.1)
Unmarried	766 (14.9)
Caregiver's occupation	
Farmer	3177 (61.8)
Non-farmer	1965 (38.2)
Caregiver accompanied by another person	
No	3608 (70.2)
Yes	1534 (29.8)

^a The other caregivers category included extended family members: there were 104 grandparents, 100 aunts, 13 uncles, 7 sisters, 1 brother and 1 cousin.

^b No other sex was reported.

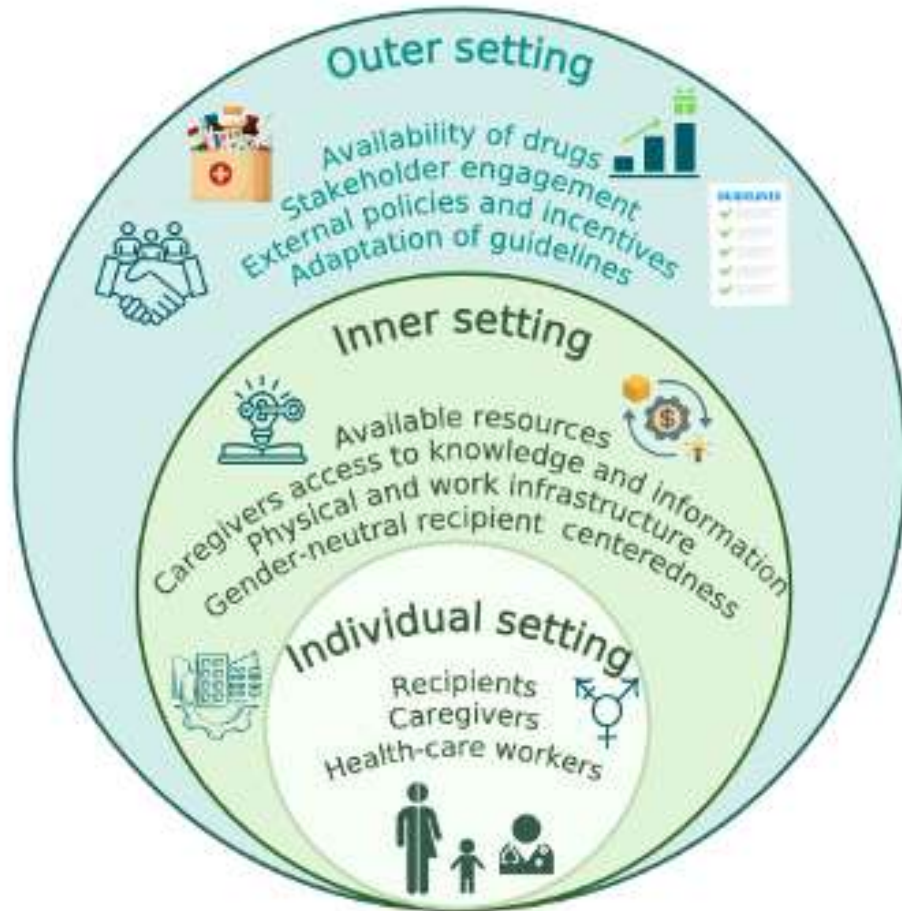
Note: inconsistencies may arise in some values due to rounding.

Table 4. Caregivers' knowledge and perceptions of schistosomiasis and praziquantel, study of praziquantel preventive chemotherapy for young children in rural Madagascar, 2023

Caregivers' knowledge or perception	No. (%) (n = 5 142)
Previous family experience with praziquantel preventive chemotherapy	
No	2123 (41.3)
Yes	2011 (39.1)
I do not know	1008 (19.6)
Accepted repeated praziquantel preventive chemotherapy for children	
No	155 (3.0)
Yes	4124 (80.2)
I do not know	863 (16.8)
Anxiety about adverse events	
No	3103 (60.4)
Yes	784 (15.2)
I do not know	1255 (24.4)
Perception that praziquantel is effective against schistosomiasis	
No	317 (6.2)
Yes	3385 (65.8)
I do not know	1440 (28.0)
Knowledge of schistosomiasis transmission routes	
No	965 (18.8)
Yes	4177 (81.2)
Aware of children's risk of schistosome infection	
No	174 (3.4)
Yes	4202 (81.7)
I do not know	766 (14.9)
Aware that schistosomiasis can be asymptomatic in children	
No	790 (15.4)
Yes	2653 (51.6)
I do not know	1699 (33.0)
Aware of children's risk of reinfection after praziquantel treatment	
No	1206 (23.5)
Yes	2712 (52.7)
I do not know	1224 (23.8)

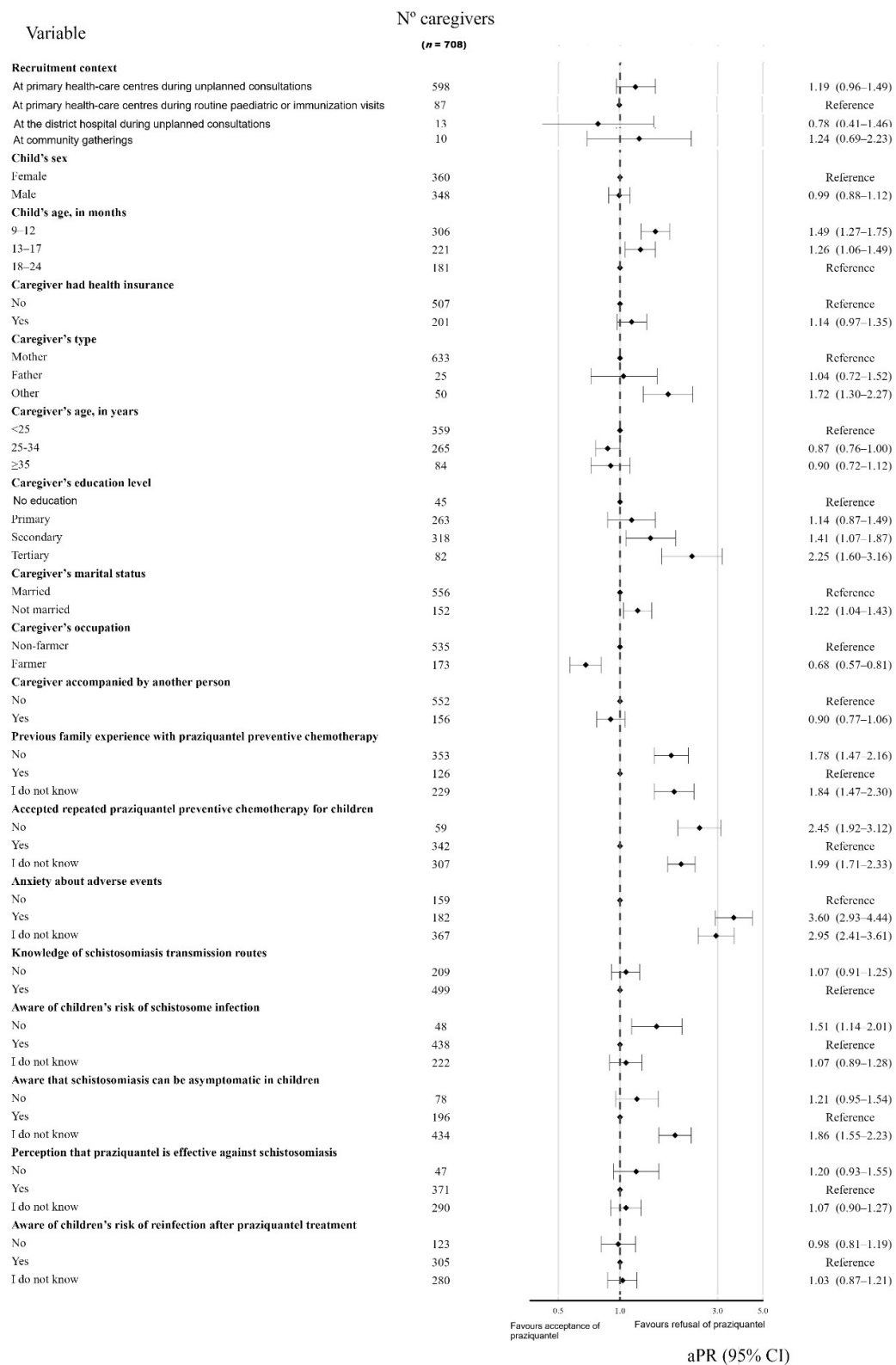
Note: inconsistencies may arise in some values due to rounding.

Fig. 1. **Adaptation of the Consolidated Framework for Implementation Research,¹⁶ study of praziquantel preventive chemotherapy for young children in rural Madagascar, 2023**



Note: The availability of drugs refers to the local availability of praziquantel and drugs for the management of adverse events. See also Table 1.

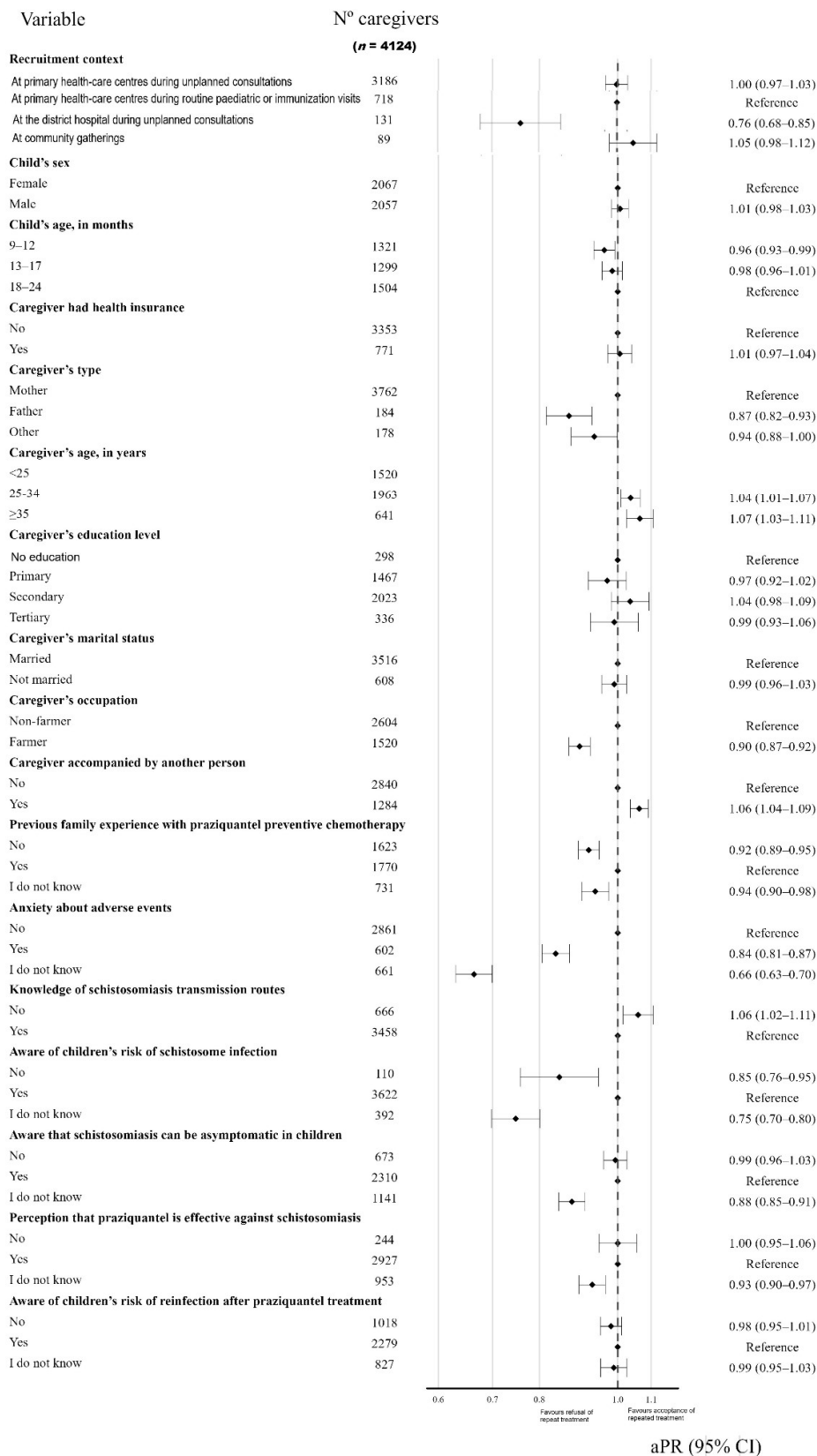
Fig. 2. Factors associated with caregivers' refusal of praziquantel for their child, praziquantel preventive chemotherapy for young children in rural Madagascar, 2023



aPR: adjusted prevalence ratio; CI: confidence interval.

Note: All children were classified as male or female.

Fig. 3. Factors associated with acceptance of repeated treatment, praziquantel preventive chemotherapy for young children in rural Madagascar, 2023



aPR: adjusted prevalence ratio; CI: confidence interval. Note: All children were classified as male or female.